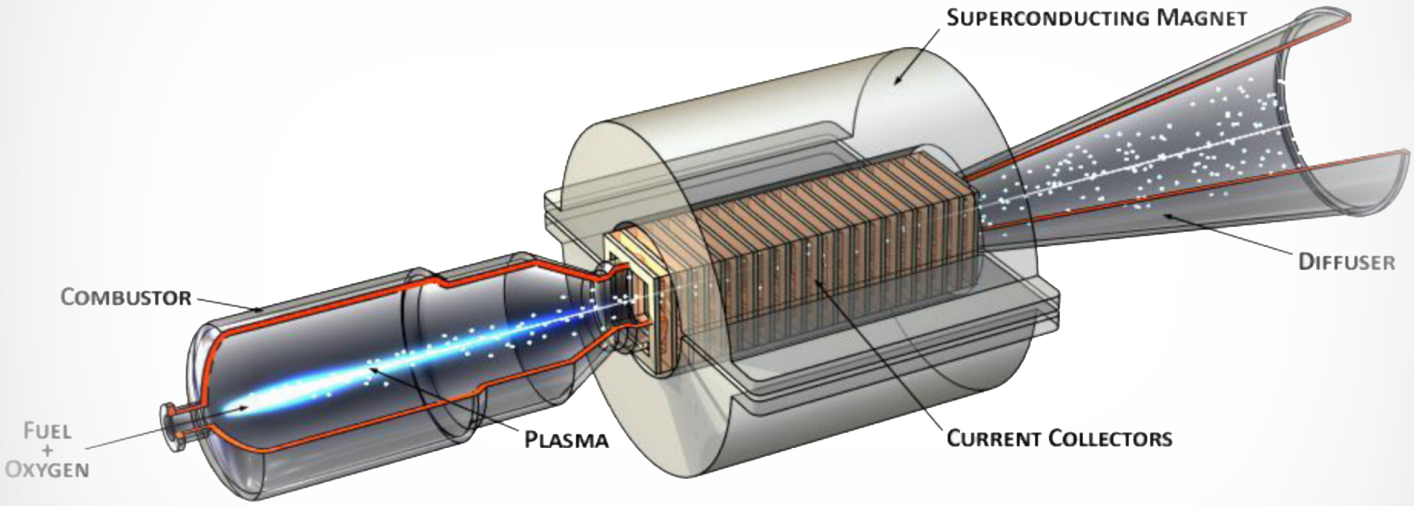
INNOVATIVE ENERGY CONCEPTS



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

OVERVIEW

Innovative Energy Concepts is concerned with the development of novel cost-effective technologies that promote efficiency, environmental performance, availability of advanced energy systems, and the development of computational tools that shorten development timelines of advanced energy systems. This area provides for fundamental and applied research in innovative concepts with a 10-25 year horizon that offers the potential for technical breakthroughs and step-change improvements in power generation and the removal of any environmental impacts from fossil energy-based power systems.

INNOVATIVE ENERGY CONCEPTS

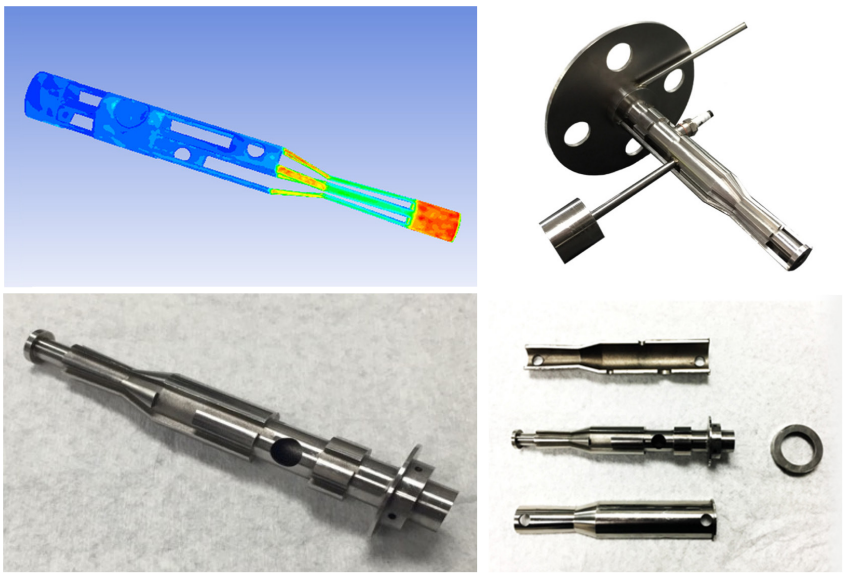
Innovative Energy Concepts (IEC) is concerned with the development of innovative, cost-effective technologies that promote efficiency, environmental performance, availability of advanced energy systems, and the development of computational tools that shorten development timelines of advanced energy systems. National Energy Technology Laboratory (NETL) is working with stakeholders to focus on two research areas:

- Advanced Power Generation Concepts such as direct power extraction, thermoelectric generation, and other innovative ideas have the potential to increase the efficiency and offset the penalty associated with capturing CO_2 from power generation from fossil fuels. Although these innovative energy systems have significant potential advantages, practical development is hindered by uncertain component performance, the need for new materials, or simply the cost of development. The goal of IEC is to utilize validated, computational simulations that can predict performance of these process technologies to identify gaps in simulations and technology and guide development and accelerate the deployment of IEC technologies.
- Power Cycling Alternatives such as power electronics and energetic materials research with application for grid-scale energy storage devices to improve reliability and stability of the grid; provide capacity to "peak shave or load shift," enabling peak loads to be met during periods when generation, transmission, and distribution assets cannot yet be brought online; enable the integration of large scale renewable energy plants into the grid; and provide more stable and efficient delivery of electrical power— including power generated from fossil fuel sources. This will result in more stable and efficient delivery of electrical power, while reducing overall CO_2 emissions.

DIRECT POWER CONVERSION

Direct Power Extraction (DPE) refers to the direct conversion of the thermal or kinetic energy in a fluid to useable electrical power. By avoiding an intermediate mechanical energy conversion step (e.g., the movement of turbine blades) power generation efficiencies can be extended beyond the current state of the art. This is because theoretical maximum cycle efficiencies are limited by the maximum cycle temperature in accordance with Carnot's rule, and turbine blades are one of the limiting factors in extending the temperatures of turbo-machinery.

*Cover image: An Oxy-fuel fired Open Cycle MHD Power Generator. A diffuser is used to slow the flow down prior to it entering a bottoming cycle.



Direct power extraction combustor designed using computational tools to operate on methane and oxygen.

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